PASSIVE COOLING AND EMI SHIELDING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation application of U.S. application Ser. No. 14/463,566, filed Aug. 19, 2014, entitled "PASSIVE COOLING AND EMI SHIELDING SYSTEM," which is a continuation of U.S. application Ser. No. 13/101,881, filed May 5, 2011, U.S. Pat. No. 8,809,697, issued Aug. 19, 2014, entitled "PASSIVE COOLING AND EMI SHIELDING SYSTEM," the entire contents of which is incorporated herein by reference.

BACKGROUND

[0002] Field

[0003] The present disclosure generally relates to systems and methods of cooling electrical components and, in particular, allowing passive cooling while also providing ElectroMagnetic Interference (EMI) shielding.

[0004] Description of the Related Art

[0005] Hospitals have a need to provide secure storage for certain medications, such as narcotics and controlled substances, while still making the medications available to care givers. One method of providing this secure storage is the use of Automatic Dispensing Machines (ADMs), which typically contain a microprocessor that is functionally connected to the hospital data systems and secure drawers and compartments containing the medications. The software of each ADM is normally configured to allow access to the medications only after certain requirements are met, such as verification that the individual requesting the medication is authorized to do so. The ADMs should be continuously operational as hospitals must provide care to their patients 24 hours a day.

[0006] Computer processors and motherboards are known to emit electromagnetic radiation across a wide frequency band due to the high frequency digital signals conducted through the circuits of the processor and on the board. To meet regulatory requirements that limit the amount of electromagnetic energy that can be radiated from electronic devices, processors are frequently mounted inside conductive enclosures. However, placing the processor and motherboard inside a sealed conductive shell has the effect of limiting the amount of cooling air that can enter and leave the enclosure, and therefore a fan is often used to force air through the enclosure to cool the internal electronics, as the processor will overheat without sufficient cooling and shut itself down to avoid permanent damage. These fans are typically considered to be noisy. Also, since the functioning of the fan is critical to the operation of the processor and therefore the ADM, the fan is a potential source of downtime of the equipment.

SUMMARY

[0007] There is a need to improve the operation of an ADM by providing sufficient cooling to the electronics through passive cooling, i.e. by natural air convection without the use of fans to blow air over the electronics, and still providing EMI shielding around the motherboard and processor to meet regulatory requirements.

[0008] The disclosed system provides passive cooling of electronics and EMI shielding of the same electronics. In the system, a heat sink is located at one edge of the electronics and designed to form a portion of the EMI shielding, with the shielding configured to form a chimney around the heat sink whereby air that has been warmed by the heat sink rises through the chimney and pulls cool air through the heat sink into the chimney. The result is a cooling and shielding system that cools electronics without the use of fans, thereby reducing the noise, cost, and reliability issues associated with cooling fans, while maintaining EMI shielding around the electronics.

[0009] In one embodiment, an electronics enclosure for providing passive cooling of electronic components while reducing electromagnetic interference (EMI) emissions is disclosed. The electronics enclosure includes an electronics assembly comprising at least one electronic component and a heat sink coupled to the electronics assembly. The heat sink has a base portion configured to thermally couple to the at least one electronic component when the heat sink is coupled to the electronic assembly. The electronics enclosure also includes a conductive enclosure forming an enclosed volume around the electronics assembly. The enclosure has a first opening configured to fit around the heat sink and at least one second opening. All non-conductive passages from the volume to the external environment have at least one cross-sectional opening having a continuous conductive perimeter with a maximum linear length within the opening of less than one quarter wavelength of a determined maximum shielding frequency.

[0010] In another embodiment, an electronics enclosure for providing passive cooling of electronic components while reducing EMI emissions is provided. The electronics enclosure includes an electronics assembly with a planar substrate having a leading edge and a trailing edge and at least one electronic component coupled to the substrate proximate to the leading edge. The electronics assembly also includes a heat sink coupled to the electronic assembly proximate to the leading edge of the substrate. The heat sink has a base portion, at least one heat pipe thermally coupled to the base portion, at least one thermal block thermally coupled to the base portion and configured to thermally couple to the at least one electronic component when the heat sink is coupled to the electronic assembly, and a plurality of fins thermally coupled to the base portion. The electronics enclosure also includes a conductive enclosure forming an enclosed volume around the electronics assembly, the enclosure comprising a first opening configured to fit around the heat sink and at least one second opening. All non-conductive passages from the volume to the external environment have at least one cross-sectional opening having a continuous conductive perimeter with a maximum linear length within the opening of less than one quarter wavelength of a determined maximum shielding frequency.

[0011] A method of passively cooling electronics while reducing conducted and radiated EMI emissions from the electronics is disclosed. The method includes the step of attaching a heat sink with a base portion to an electronics assembly having at least one electronic component that requires cooling and an interface connector having at least one contact with an interface impedance, the interface connector configured to mate and match impedances with a docking connector having at least one contact with an interface impedance thereby reducing the EMI radiated from conductors connected to the contacts of the docking connector, such that the base portion is thermally coupled to the